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1 Zippered polygon meshes from range images

Greg Turk, Marc Levoy

July 1994 **Proceedings of the 21st annual conference on Computer graphics and interactive techniques**

Full text available: pdf(62.55 KB) ps(259.20 KB) Additional Information: full citation, abstract, references, citings, index terms

Range imaging offers an inexpensive and accurate means for digitizing the shape of three-dimensional objects. Because most objects self occlude, no single range image suffices to describe the entire object. We present a method for combining a collection of range images into a single polygonal mesh that completely describes an object to the extent that it is visible from the outside.The steps in our method are: 1) align the meshes with each other using a modified iterated closest- ...

Keywords: polygon mesh, range images, structured light range scanner, surface fitting, surface reconstruction

2 A survey of methods for recovering quadrics in triangle meshes

Sylvain Petitjean

June 2002 **ACM Computing Surveys (CSUR)**, Volume 34 Issue 2

Full text available: pdf(3.91 MB) Additional Information: full citation, abstract, references, citings, index terms

In a variety of practical situations such as reverse engineering of boundary representation from depth maps of scanned objects, range data analysis, model-based recognition and algebraic surface design, there is a need to recover the shape of visible surfaces of a dense 3D point set. In particular, it is desirable to identify and fit simple surfaces of known type wherever these are in reasonable agreement with the data. We are interested in the class of quadric surfaces, that is, algebraic surfa ...

Keywords: Data fitting, geometry enhancement, local geometry estimation, mesh fairing, shape recovery

3 Reconstruction and triangulation: Efficient estimation of 3D Euclidean distance fields from 2D range images

Sarah F. Frisken, Ronald N. Perry

October 2002 **Proceedings of the 2002 IEEE symposium on Volume visualization and graphics**

Full text available: pdf(12.39 MB) Additional Information: full citation, abstract, references, index terms

Several existing algorithms for reconstructing 3D models from range data first approximate the object's 3D distance field to provide an implicit representation of the scanned object and then construct a surface model of the object using this distance field. In these existing approaches, computing and storing 3D distance values from range data contribute significantly to the computational and storage requirements. This paper presents an efficient method for estimating the 3D Euclidean distance fi ...

Keywords: 3D scanning, ADFs, distance fields, range images

4 Model-based object recognition in dense-range images—a review

Farshid Arman, J. K. Aggarwal

March 1993 **ACM Computing Surveys (CSUR)**, Volume 25 Issue 1

Full text available: pdf(3.42 MB) Additional Information: full citation, abstract, references, citings, index terms, review

The goal in computer vision systems is to analyze data collected from the environment and derive an interpretation to complete a specified task. Vision system tasks may be divided into data acquisition, low-level processing, representation, model construction, and matching subtasks. This paper presents a comprehensive survey of model-based vision systems using dense-range images. A comprehensive survey of the recent publications in each subtask pertaining to dense-range image object recogni ...

Keywords: 3D object recognition, 3D representations, CAD-based vision, dense-range images, image understanding

5 Jump map-based interactive texture synthesis

Steve Zelinka, Michael Garland

October 2004 **ACM Transactions on Graphics (TOG)**, Volume 23 Issue 4

Full text available: pdf(529.89 KB) Additional Information: full citation, abstract, references, index terms

We present techniques for accelerated texture synthesis from example images. The key idea of our approach is to divide the task into two phases: analysis, and synthesis. During the analysis phase, which is performed once per sample texture, we generate a jump map. Using the jump map, the synthesis phase is capable of synthesizing texture similar to the analyzed example at interactive rates. We describe two such synthesis phase algorithms: one for creating images, and one for di ...

Keywords: Interactive texture synthesis, jump maps, texturing surfaces

6 The holodeck ray cache: an interactive rendering system for global illumination in nondiffuse environments

Gregory Ward, Maryann Simmons

October 1999 **ACM Transactions on Graphics (TOG)**, Volume 18 Issue 4

Full text available: pdf(935.74 KB) Additional Information: full citation, abstract, references, citings, index terms

We present a new method for rendering complex environments using interactive, progressive, view-independent, parallel ray tracing. A four-dimensional holodeck data structure serves as a rendering target and caching mechanism for interactive walk-throughs of nondiffuse environments with full global illumination. Ray sample density varies locally

according to need, and on-demand ray computation is supported in a parallel implementation. The holodeck file is stored on disk and ...

Keywords: illumination, image reconstruction, mesh generation, ray tracing, rendering system, virtual reality

7 Articulated body deformation from range scan data

Brett Allen, Brian Curless, Zoran Popović

July 2002 **ACM Transactions on Graphics (TOG) , Proceedings of the 29th annual conference on Computer graphics and interactive techniques**, Volume 21 Issue 3

Full text available: pdf(2.84 MB) Additional Information: full citation, abstract, references, citings, index terms

This paper presents an example-based method for calculating skeleton-driven body deformations. Our example data consists of range scans of a human body in a variety of poses. Using markers captured during range scanning, we construct a kinematic skeleton and identify the pose of each scan. We then construct a mutually consistent parameterization of all the scans using a posable subdivision surface template. The detail deformations are represented as displacements from this surface, and holes are ...

Keywords: animation, character animation, deformation, human body simulation, synthetic actor

8 Status report of the graphic standards planning committee

Computer Graphics staff

August 1979 **ACM SIGGRAPH Computer Graphics**, Volume 13 Issue 3

Full text available: pdf(15.01 MB) Additional Information: full citation, references, citings

9 Simplifying complex environments using incremental textured depth meshes

Andrew Wilson, Dinesh Manocha

July 2003 **ACM Transactions on Graphics (TOG)**, Volume 22 Issue 3

Full text available: pdf(3.84 MB) Additional Information: full citation, abstract, references, index terms

We present an incremental algorithm to compute image-based simplifications of a large environment. We use an optimization-based approach to generate samples based on scene visibility, and from each viewpoint create textured depth meshes (TDMs) using sampled range panoramas of the environment. The optimization function minimizes artifacts such as skins and cracks in the reconstruction. We also present an encoding scheme for multiple TDMs that exploits spatial coherence among different viewpoints. ...

Keywords: interactive display, simplification, spatial encoding, textured depth meshes, walkthrough

10 Image-driven simplification

Peter Lindstrom, Greg Turk

July 2000 **ACM Transactions on Graphics (TOG)**, Volume 19 Issue 3

Full text available: pdf(1.98 MB) Additional Information: full citation, abstract, references, citings, index terms

We introduce the notion of image-driven simplification, a framework that uses images to decide which portions of a model to simplify. This is a departure from approaches that make polygonal simplification decisions based on geometry. As with many methods, we use the

edge collapse operator to make incremental changes to a model. Unique to our approach, however, is the use at comparisons between images of the original model against those of a simplified model to determine the ...

Keywords: image metrics, level-of-detail, polygonal simplification, visual perception

11 A framework for geometric warps and deformations
Tim Milliron, Robert J. Jensen, Ronen Barzel, Adam Finkelstein
January 2002 **ACM Transactions on Graphics (TOG)**, Volume 21 Issue 1

Full text available: pdf(3.20 MB) Additional Information: full citation, abstract, references, citings, index terms

We present a framework for geometric warps and deformations. The framework provides a conceptual and mathematical foundation for analyzing known warps and for developing new warps, and serves as a common base for many warps and deformations. Our framework is composed of two components: a generic modular algorithm for warps and deformations; and a concise, geometrically meaningful formula that describes how warps are evaluated. Together, these two elements comprise a complete framework useful for ...

Keywords: Deformation, warp

12 Session P1: point-based rendering and modeling: Point set surfaces
Marc Alexa, Johannes Behr, Daniel Cohen-Or, Shachar Fleishman, David Levin, Claudio T. Silva
October 2001 **Proceedings of the conference on Visualization '01**

Full text available: pdf(5.84 MB) Publisher Site Additional Information: full citation, abstract, references, citings, index terms

We advocate the use of point sets to represent shapes. We provide a definition of a smooth manifold surface from a set of points close to the original surface. The definition is based on local maps from differential geometry, which are approximated by the method of moving least squares (MLS). We present tools to increase or decrease the density of the points, thus, allowing an adjustment of the spacing among the points to control the fidelity of the representation.To display the point set surfac ...

Keywords: 3D acquisition, moving least squares, point sample rendering, surface representation and reconstruction

13 Color gamut mapping and the printing of digital color images
Maureen C. Stone, William B. Cowan, John C. Beatty
October 1988 **ACM Transactions on Graphics (TOG)**, Volume 7 Issue 4

Full text available: pdf(6.06 MB) Additional Information: full citation, abstract, references, citings, index terms, review

Principles and techniques useful for calibrated color reproduction are defined. These results are derived from a project to take digital images designed on a variety of different color monitors and accurately reproduce them in a journal using digital offset printing. Most of the images printed were reproduced without access to the image as viewed in its original form; the color specification was derived entirely from calorimetric specification. The techniques described here are not specific ...

14 Enabling level-of-detail matching for exterior scene synthesis
Randy K. Scoggins, Robert J. Moorhead, Raghu Machiraju
October 2000 **Proceedings of the conference on Visualization '00**

Full text available: pdf(307.15 KB) Additional Information: full citation, citings, index terms

Keywords: image metrics, level-of-detail, multiresolution model, perception, rendering, terrain visualization

15 The digital Michelangelo project: 3D scanning of large statues

Marc Levoy, Kari Pulli, Brian Curless, Szymon Rusinkiewicz, David Koller, Lucas Pereira, Matt Ginzton, Sean Anderson, James Davis, Jeremy Ginsberg, Jonathan Shade, Duane Fulk

July 2000 **Proceedings of the 27th annual conference on Computer graphics and interactive techniques**

Full text available: pdf(10.83 MB) Additional Information: full citation, abstract, references, citings, index terms

We describe a hardware and software system for digitizing the shape and color of large fragile objects under non-laboratory conditions. Our system employs laser triangulation rangefinders, laser time-of-flight rangefinders, digital still cameras, and a suite of software for acquiring, aligning, merging, and viewing scanned data. As a demonstration of this system, we digitized 10 statues by Michelangelo, including the well-known figure of David, two building interiors, and all 1,163 extant f ...

Keywords: 3D scanning, cultural heritage, graphics systems, mesh generation, range images, rangefinding, reflectance and shading models, sensor fusion

16 Creating generative models from range images

Ravi Ramamoorthi, James Arvo

July 1999 **Proceedings of the 26th annual conference on Computer graphics and interactive techniques**

Full text available: pdf(8.54 MB) Additional Information: full citation, references, citings, index terms

Keywords: curves and surfaces, generative models, procedural modeling, range images

17 Multiple-center-of-projection images

Paul Rademacher, Gary Bishop

July 1998 **Proceedings of the 25th annual conference on Computer graphics and interactive techniques**

Full text available: pdf(1.47 MB) Additional Information: full citation, references, citings, index terms

Keywords: image-based rendering, multiple-center-of-projection images

18 Image-based reconstruction of spatial appearance and geometric detail

Hendrik P. A. Lensch, Jan Kautz, Michael Goesele, Wolfgang Heidrich, Hans-Peter Seidel

April 2003 **ACM Transactions on Graphics (TOG)**, Volume 22 Issue 2

Full text available: pdf(302.22 KB) Additional Information: full citation, abstract, references, citings, index terms

Real-world objects are usually composed of a number of different materials that often show subtle changes even within a single material. Photorealistic rendering of such objects

requires accurate measurements of the reflection properties of each material, as well as the spatially varying effects. We present an image-based measuring method that robustly detects the different materials of real objects and fits an average bidirectional reflectance distribution function (BRDF) to each of them. In or ...

Keywords: BRDF measurement, normal map acquisition, photometric stereo, shape from shading, spatially varying BRDFs

19 Smooth surface reconstruction via natural neighbour interpolation of distance functions
Jean-Daniel Boissonnat, Frédéric Cazals
May 2000 **Proceedings of the sixteenth annual symposium on Computational geometry**
Full text available: pdf(1.00 MB) Additional Information: full citation, references, citings, index terms

20 View planning for automated three-dimensional object reconstruction and inspection
William R. Scott, Gerhard Roth, Jean-François Rivest
March 2003 **ACM Computing Surveys (CSUR)**, Volume 35 Issue 1
Full text available: pdf(517.25 KB) Additional Information: full citation, abstract, references, index terms

Laser scanning range sensors are widely used for high-precision, high-density three-dimensional (3D) reconstruction and inspection of the surface of physical objects. The process typically involves planning a set of views, physically altering the relative object-sensor pose, taking scans, registering the acquired geometric data in a common coordinate frame of reference, and finally integrating range images into a nonredundant model. Efficiencies could be achieved by automating or semiautomating ...

Keywords: View planning, object inspection, object reconstruction, range images

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